IMPORTANT: This syllabus form should be submitted to OAA (gsbs_academic_affairs@uth.tmc.edu) a week before the start of each semester.

NOTE to STUDENTS: If you need any accommodations related to attending/enrolling in this course, please contact one of the Graduate School's 504 Coordinator, Natalie Sirisaengtaksin, PhD. We ask that you notify GSBS in advance (preferably at least 3 days before the start of the semester) so we can make appropriate arrangements.

<table>
<tr>
<td>Term and Year: Fall 2025

Course Number and Course Title:
GS03 1231: Current Methods in Molecular and Translational Biology Module 3: Structural and Functional Analysis of Proteins

Credit Hours: 1

Prerequisites: The GSBS Core Course is a prerequisite for PhD students. While there is no other specific prerequisite for this course, registered students are expected to have a basic understanding of protein secondary and tertiary structure and taken undergraduate biochemistry, chemistry or physics courses.

Meeting Location: UTHealth Houston
McGovern Medical School

Building/Room#: MSB 3.301 (or TBA)</td>
<td>Program Required Course: No

Approval Code: No

Audit Permitted: Yes

Classes Begin: September 29, 2025

Classes End: October 29, 2025</td>
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</table>

Class Meeting Schedule

Day	Time
Sept. 29 – Oct. 27, 2025 (M, W, F)	**3:00-4:00 p.m.**

<table>
<tr>
<td>Course Director

Name and Degree: Alemayehu Gorfe, PhD
Title: Professor
Department:
Institution: UTHealth Houston
Email Address: Alemayehu.G.Abebe@uth.tmc.edu
Contact Number: 281-844-8396</td>
<td>Instructors

1. Alemayehu A. Gorfe, PhD
Institution: UTHealth Houston
Email Address: Alemayehu.g.abebe@uth.tmc.edu

2. Chen Zheng, PhD
Institution: UTHealth Houston
Email Address: Zheng.Chen.1@uth.tmc.edu</td>
</tr>
</table>

NOTE: Office hours are available by request. Please email me to arrange a time to meet.	3. **John Putkey, PhD** Institution: UTHealth Houston Email Address: John.Putkey@uth.tmc.edu 4. **Vasanthi Jayaraman, PhD** Institution: UTHealth Houston Email: Vasanthi.Jayaraman@uth.tmc.edu 5. **Lei Zheng, PhD** Institution: UTHealth Houston Email Address: Lei.Zheng@uth.tmc.edu 6. **Irina Serysheva, PhD** Institution: UTHealth Houston Email Address: Irina.I.Serysheva@uth.tmc.edu 7. **Matthew Baker, PhD** Institution: UTHealth Houston Email Address: Matthew.l.Baker@uth.tmc.edu

Course Description:

This module is a component of the course "Current Methods in Molecular and Translational Biology" that is designed to introduce students to methods they can apply to their own research and to evaluate the rationale and pros and cons of specific techniques that are employed in experiments they are exposed to at seminars and conferences. This module provides an overview of modern experimental and computational structural biology techniques for the study of protein structure, dynamics and function, and introduces fundamental concepts of chemical and computational screening methods of targeted drug discovery. Major experimental techniques to be covered include NMR spectroscopy, X-ray crystallography, Cryo-EM microscopy, single-molecule FRET, and high throughput chemical screeding of small molecules. Key methods in computational structural biology will include concepts and applications of molecular dynamics (MD) simulations, artificial intelligence-based methods for structure prediction and modeling, and structure-based virtual screening of small molecule ligands. Depending on a student's project, this course can be taken as an elective to satisfy the 3-units Methods in Molecular Translational Biology (MTB) course required by MTB program students, in combination with any of the other three modules of the Course for 2-3 credits, or as a stand-alone 1-credit course by any GSBS student or students from affiliated institutions.

Textbook/Supplemental Reading Materials

- No specific, general-purpose textbook or supplementary material is recommended. However, instructors may recommend literature reading including reference books and review articles relevant for their specific lectures.

Course Objective/s:

Upon successful completion of this course, students will have acquired a basic understanding of current techniques for protein structure determination including the analysis of conformational changes and dynamics. Students will also be introduced to chemical and structure-based virtual screenings of small molecule ligands for the development of targeted inhibitors. A key objective is to provide the students with the basic concepts necessary and the key areas of applications of structural biology techniques to enable them to ask relevant research questions in their own projects, in collaborative work, or in scientific communications.

***Specific Learning Objectives*:**

1. Introduce students to the fundamental concepts of protein structure determination techniques.
2. Enable students to gain insights, through examples, into the practical applications of structural biology techniques in addressing fundamental biological problems.
3. Introduce students to current computational methods for protein structure prediction and modeling.
4. Instill in students an appreciation of the fundamental concepts of protein conformational changes, their investigation using experimental and computational methods, and their applications in the study of protein function.
5. Introduce chemical and structure-based virtual high throughput screening of compound libraries as examples of the many different translational applications of structural biology methods.

Student responsibilities and expectations:

Students enrolled in this course will be expected to perform the following activities during the period of the course:

1. Read, process, and review lecture materials, review and critically assess assigned (review) articles
2. Attend all lectures and participate in and contribute to course discussions during lecture sessions
3. Participate in a field trip and practical demonstrations
4. Prepare for and take a final examination based on lecture and reading material

Students are expected to complete all assigned reading material (lecture materials from prior years, reviews and related research literature assigned by instructors) prior to class. While you may work and discuss all course materials and assignments in groups, all writing assignments must be your own. Whenever relevant, specific guidelines will be provided on whether using AI-generated content is permitted. Plagiarism and failure to properly cite scientific literature and other sources will not be tolerated and are grounds for dismissal from the course and further GSBS disciplinary action. Cheating or engaging in unethical behavior during examinations will be grounds for dismissal from the course without credit and further GSBS disciplinary action.

Grading System: **Letter Grade: (A-F)**	
Student Assessment and Grading Criteria:	
Percentage	**Description**
Homework	At their discretion, Instructors may assign a review article(s) and students will submit a short (about 1 page) summary and critic of the article. If homework is assigned for a specific lecture, the homework assignment will be in lieu of questions on that lecture subject matter on the exam.
Final Exam (90%)	Two (2) in-class exams will represent 90% of the total grade. The specific percent of the total grade assigned to each exam will be at the discretion of the course director. In-class exam 1 will cover all material presented prior to the exam. Exam 2 will cover material presented after Exam 1. All individual lectures will be assigned equal points on the exams. Homework may be assigned by a lecturer for a specific lecture in lieu of questions on the exam. Points awarded for the homework assignment will be added to the total points received for the in-class exam.
Participation and/or Attendance (10%)	The material covered in these lectures is likely new to many students. Therefore, attendance and participation in classroom discussions is considered critical. Attendance will be assessed toward 10% of final grade to encourage participation.

CLASS SCHEDULE

Date	Duration (Hour(s) taught by lecturer)	Lecture Topic	Lecturer/s
09/29	1	High throughput chemical screens	J. Chen
10/01	1	Advanced Spectroscopy	V. Jayaraman
10/03	1	X-ray crystallography: theory and concepts	L. Zheng
10/06	1	X-ray crystallography: practical applications	L. Zheng
10/08		NMR spectroscopy: theory and concept	J. Putkey
10/10	1	NMR spectroscopy: practical applications	J. Putkey
10/13	1	Cryo-electron microscopy: theory and concept	I. Serysheva
10/15	1	Cryo-electron microscopy: practical applications	I. Serysheva
10/17	1	Molecular dynamics simulations: Theory and concept	A. Gorfe
10/20	1	Molecular dynamics simulations: practical applications	A. Gorfe
10/22	1	High throughput virtual screens	A Gorfe
10/24	1	Machine learning and AI in computational structural = in structural Biology	M. Baker
10/27	TBD	Structure Exam	

AG/jal